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(54) INSTALLATION FOR CLEANING DUST-LADEN EXHAUST GASES

(71) We, POLYSIUS G.M.B.H., a body corporate organised under the Laws of Germany of Graf-Galen Strasse 17, Postfach 340, 4723 Neubeckum, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an installation for cleaning dust-laden exhaust gases from furnaces, particularly cupola furnaces.

Dust-laden exhaust gases from furnaces are generally cleaned in multi-cyclone installations, such as one consisting of a number of individual identical cyclones which are connected in parallel and provided with tangential gas inlets and which are disposed in rows side by side. The gases are supplied to these separators through a gas distributor duct which is common to the separators, and the cleaned gases are discharged through a clean gas collecting duct.

A multi-cyclone of this type, in which the individual cyclones are disposed in a very small space, nevertheless has the disadvantage that in consequence of their varying distances from the distributor duct inlet for the exhaust gases to be freed from dust, the cyclones connected in parallel with one another are supplied with unequal amounts of gas and in addition are loaded with dust from all the size fractions contained in the gases. The degree of separation which can be achieved with an installation of this type is therefore only low and does not satisfy the requirements imposed on a modern dust removal apparatus.

In order to increase the efficiency of cyclone dust extractors, dust extraction installations have therefore already been proposed in which a plurality of cyclones are provided on the outside of the casing of a preseparator constructed as a sedimentation shaft and are connected thereto by gas supply ducts, the vortex finders of said cyclones leading into a clean gas collecting chamber provided above the preseparator. In this arrangement the exhaust gases are introduced centrally from above into the preseparator and are deflected in the latter, then passing through the cyclones and in a precleaned condition pass in the opposite direction into the clean gas collecting chamber.

Although this construction permits more uniform distribution over the various cyclones of the gases to be cleaned, nevertheless here again the fine separators are not to any substantial extent freed from the load of coarse dust, because the degree of separation achieved by the preseparator, in which a precleaning of the exhaust gases is effected solely by their simple deflection, is very low in this case. Another disadvantage is the fact that an arrangement of this type requires considerable space, because the minimum length of the gas inlet and outlet pipes connecting the cyclones to the preseparator casing results in considerable space being required for the complete installation when the cyclones are distributed around the preseparator. Moreover, previously proposed cyclones have long material discharge pipes serving to introduce the separated dusts into the bottom part of the preseparator. This entails an increase in the height of the arrangement.

It is an object of the present invention, in the case of an installation of the first mentioned type, to improve considerably the degree of separation of the preseparator and therefore the degree of dust extraction of the fine separators, while avoiding the last-mentioned disadvantages.

According to the present invention, there is provided an installation for cleaning dust-laden gases, comprising a substantially vertical gas inlet pipe for receiving the gases to be cleaned at its upper end and provided at its lower end with means for inducing a rotary spinning motion into the gases, the inlet pipe widening towards its outlet, a preseparator casing surrounding and spaced from the lower end of said inlet pipe and extending downwardly to form an outlet for coarse dust particles, a plurality of cyclones arranged in parallel around said preseparator casing, an outer casing for the installation, a first and lower annular wall connecting the outer casing to the preseparator casing to

define with the casings a fine dust collecting hopper surrounding the downwardly extending portion of the preseparator casing, and a second and upper annular wall connecting the outer casing with the gas inlet pipe to define with the outer casing and the pipe a clean gas chamber having an outlet for clean gases, the cyclones being disposed between said annular walls and casings and arranged so as to receive substantially equal amounts of precleaned gases from within the preseparator casing and to pass cleaned gases to the clean gas chamber and fine dust to the fine dust collecting hopper.

In an installation constructed in this manner, effective pre-extraction of dust is ensured in a reliable manner, because the dust-laden exhaust gases expelled in a rotary movement from the gas supply pipe perform a spiral movement in the preseparator, come into contact with the wall of the latter through the effect of centrifugal forces and there lose their kinetic energy, whereby the larger particles of dust are separated from the gases. Since a negative pressure is produced inside the casing by a suction blower drawing the cleaned gases out of the clean gas collecting chamber, the gases rotating in the preseparator immediately change their direction of movement and flow to the cyclones for the purpose of further dust extraction. In this way the separation operation, initiated by centrifugal action in the preseparator, is further assisted and completed by a following deflection of the gases, which reduces their velocity. Since the coarse dust fraction has to a large extent been removed from the gases in the preseparator and the fine dust separators (cyclones) connected in parallel and grouped at the same distance around the preseparator have been fed with approximately equal volumes of precleaned gas, all the cyclones are used in an optimum manner and a high degree of separation and consequently favourable extraction of dust from the exhaust gases are achieved in them. Apart from this effective coupling of the preseparation and after-separation, an installation of this type enables the coarse and fine dusts to be collected separately, which is desirable for certain purposes.

The present gas cleaning installation requires little space because of its spatially compact construction, and is made of cyclones which have no inlet spiral, which have an axial gas flow inlet, and which are disposed with minimum spacing around the vortex tube. As a result, the total diameter of this installation is considerably reduced in comparison with the usual construction of multi-cyclones having after-separators disposed outside the preseparator; in addition, gas supply ducts, which must be of considerable length, between the preseparator and the cyclones, as well as their clean gas outlet connections leading into the clean gas collecting chamber, are no longer required. Because in the present installation the radial walls holding the installation together and connecting the casing to the preseparator and to the gas supply pipe simultaneously secure the cyclones in their stationary position, special supporting elements for the after-separators are here not required.

In order to enable the invention to be more readily understood, reference will now be made to the accompanying drawing which illustrates diagrammatically and by way of example a perspective cut-away view of one embodiment thereof.

Referring now to the drawing there is shown a gas cleaning installation equipped with a preseparator and with the cyclones. In a vertical casing 1, which tapers conically in the downward direction, there is disposed centrally a gas supply pipe 2 which is fed with exhaust gases from a furnace (not shown in the drawing) and which widens towards its outlet 3 in the form of a truncated cone. In its outlet region, the gas supply pipe 2 is provided with guide elements 4 for indusing a rotary spinning motion into the gas. The gas supply pipe extends inside the casing 1 into a preseparator 5 enclosed coaxially by said casing. The preseparator 5, which has a substantially larger diameter than the gas supply pipe 2, is connected rigidly to the casing 1 by an annular wall 6. The casing 1 extends downwards in the form of a fine dust collecting hopper 7, which has a fine material outlet 8 and coaxially surrounds the preseparator 5, at the lowest part of which there is situated a coarse dust outlet 9. The uppermost part of the casing 1 is formed as a clean gas collecting chamber 10 which tapers upwards. Inside the casing 1, between the fine dust collecting hopper 7 and the clean gas collecting chamber 10, cyclones 11 are distributed in the form of a ring around the preseparator 5. These cyclones 11 have axial gas inlets 12, which for the purpose of producing a gas vortex are equipped with guide blades 13. At their bottom ends, the cyclones 11 have material outlets 14 disposed on the annular wall 6, which is formed with apertures 15 into which the material outlets 14 fit. Vortex finders 16 of the cyclones 11 lead into the clean gas collecting chamber 10 and are fixed in an annular wall 17 which forms the bottom of the clean gas collecting chamber 10 and to the inner edge of which there is connected a conical wall 18, which is fastened on the gas supply pipe 2 and stiffens the arrangement.

In the operation of this installation, dust-laden exhaust gases blown into the gas supply pipe 2 are caused to rotate by the guide elements 4 of the latter and enter the preseparator 5. The coarse dust thus first

moves on a spiral path, comes into contact with the wall of the preseparator 5 under the effect of centrifugal force and falls into the lowest part of the preseparator. In consequence of the negative pressure prevailing in the casing 1, the gases then change their direction of movement and in a precleaned condition flow through the open top end of the preseparator 5 to the cyclones 11, which they enter in equal quantities, passing between their guide blades 13. In the cyclones, the fine dust is extracted from the precleaned gases and is collected in the fine dust collecting hopper 7. The clean gases then pass out of the installation by way of a blower (not shown in the drawing) connected to a clean gas outlet 19 of the clean gas collecting chamber 10.

WHAT WE CLAIM IS:—

1. An installation for cleaning dust-laden gases, comprising a substantially vertical gas inlet pipe for receiving the gases to be cleaned at its upper end and provided at its lower end with means for inducing a rotary spinning motion into the gases, the inlet pipe widening towards its outlet, a preseparator casing surrounding and spaced from the lower end of said inlet pipe and extending downwardly to form an outlet for coarse dust particles, a plurality of cyclones arranged in parallel around said preseparator casing, an outer casing for the installation, a first and lower annular wall connecting the outer casing to the preseparator casing to define with the casings a fine dust collecting hopper surrounding the downwardly extending portion of the preseparator casing, and a second and upper annular wall connecting the outer casing with the gas inlet pipe to define with the outer casing and the pipe a clean gas chamber having an outlet for clean gases, the cyclones being disposed between said annular walls and casings and arranged so as to receive substantially equal amounts of precleaned gases from within the preseparator casing and to pass cleaned gases to the clean gas chamber and fine dust to the fine dust collecting hopper.

2. An installation as claimed in Claim 1, wherein the cyclones are placed with their material outlets in the first annular wall which is formed with apertures corresponding to the inside cross-sections of the material outlets of the cyclones.

3. An installation as claimed in Claim 1 or Claim 2, wherein the vortex finders of the cyclones are connected in a gastight manner to the second annular wall.

4. An installation for purifying dust laden exit gases from a furnace substantially as hereinbefore described with reference to the accompanying drawing.

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